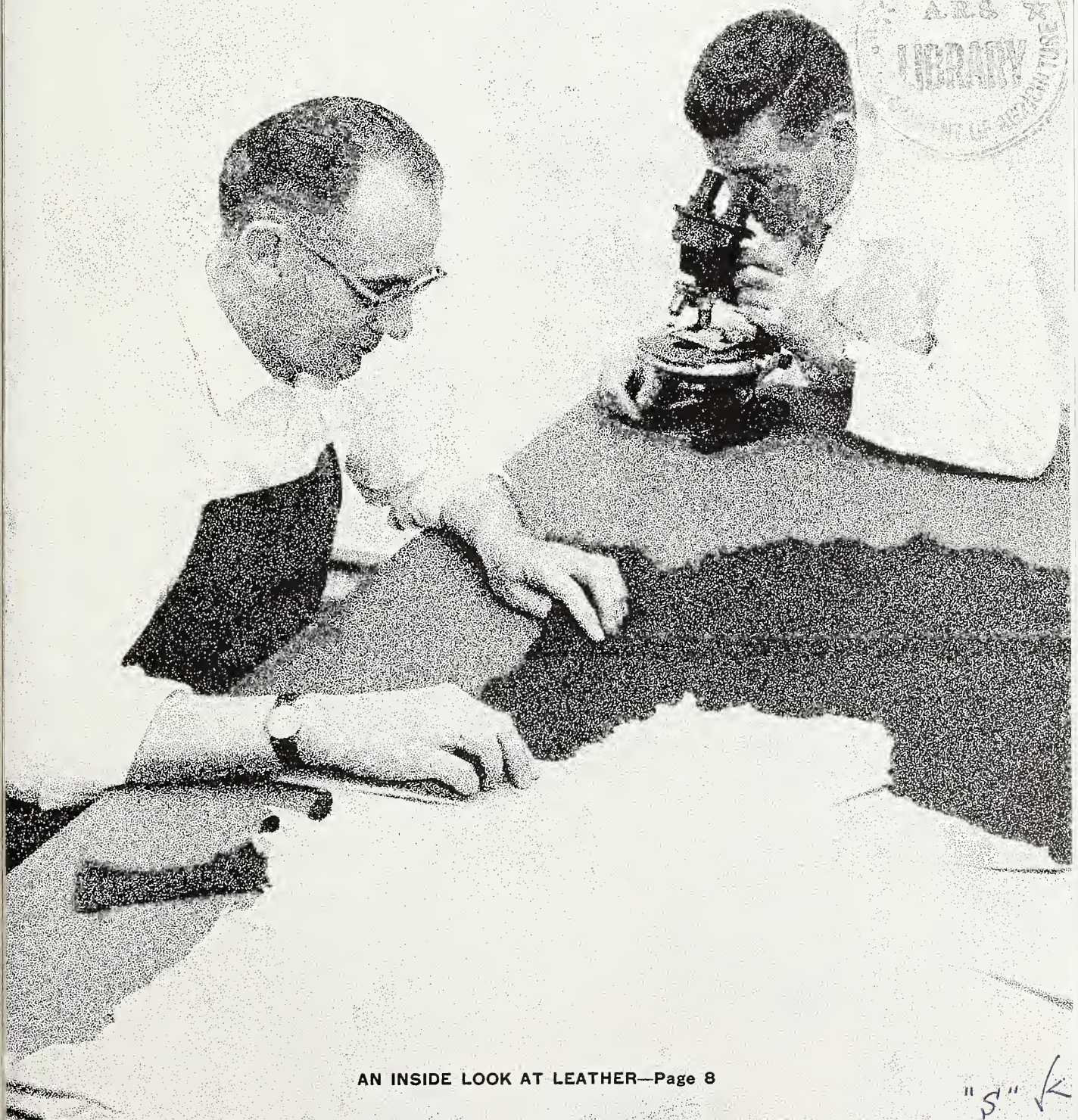
AGRICULTURAL
Research
U.S. DEPARTMENT OF AGRICULTURE

JULY 1965



AN INSIDE LOOK AT LEATHER—Page 8

"S" √

AGRICULTURAL
Research

July 1965/Vol. 14, No. 1

Imagination Is Boundless

Secretary Freeman recently made a 3-day trip to see first hand some of the Department's research and pest control work.

He visited the Northern and Southern utilization research laboratories, Peoria, Ill., and New Orleans, La., and the Southwest screwworm eradication headquarters, Mission, Texas. At each location, the scientists showed him their work and discussed results.

At Peoria, the Secretary heard, for example, how utilization research has helped elevate the soybean from a minor forage crop to the leading U.S. oilseed crop . . . how a special starch made from corn and wheat adds strength to paper products . . . and how linseed oil from flaxseed protects concrete highways against freeze-thaw.

At New Orleans, he saw research results that are updating cotton to meet modern needs in providing fabrics that resist fire, rot, and scorch; that drip dry and need little or no ironing; and that have built-in stretch.

He sampled, among other products, low-calorie peanuts developed for weight-conscious consumers and instant sweetpotato flakes that save time for housewives. Four manufacturing plants—all located in communities under 2,500 population—are now producing the flakes.

At Mission, Secretary Freeman was joined by the Mexican Minister of Agriculture, Juan Gil Preciado. Together they viewed one of the largest—and most imaginative—peacetime uses of atomic energy in the world today.

By raising and sterilizing screwworm flies with Cobalt-60—and releasing them over infested areas—regulatory workers have virtually eradicated the screwworm from the Southwest, as they did in the Southeast several years ago. This program has resulted in a direct saving of more than $80 million annually to livestock producers.

At the conclusion of his trip, Secretary Freeman said: "We have seen during these 3 days that in America today our farms are bounded only by the imagination of man. And fortunately, that imagination is boundless . . . Emanating from these scientific centers are new products and processes whose benefits spread far beyond this Nation's farms—to help build a greater society."

Editor: R. E. Enlow
Contributors to this issue:
R. J. Anzelmo, M. C. Audsley,
V. R. Bourdette, J. R. Deatherage,
A. J. Feeney, M. B. Heppner,
J. G. Nordquist, R. T. Prescott

AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service, United States Department of Agriculture, Washington, D.C., 20250. Printing has been approved by the Bureau of the Budget, August 15, 1958. Yearly subscription rate is $1 in the United States and countries of the Postal Union, $1.50 in other countries. Single copies are 15 cents each. Subscription orders should be sent to Superintendent of Documents, Government Printing Office, Washington, D.C., 20402. Information in this periodical is public property and may be reprinted without permission. Mention of the source will be appreciated but is not required.

Orville L. Freeman, Secretary
U.S. Department of Agriculture

G. W. Irving, Jr., Administrator
Agricultural Research Service

These Angus twins had been on feed for about 6 months at 15½ months of age. The bull (left) weighed 902 pounds and was slaughtered; the steer weighed 722 pounds and was to be fed another 2 months.

Does Bull Beef Have A Future?

Weanling Bulls Grow Faster Than Their Twin Steer Counterparts—Save Feedlot Labor, Overhead Costs

■ The maxim that bull beef is suitable only for canning or making bologna needs to be reconsidered.

Not that beef from *old* bulls is suitable for anything more than that.

But the quality of lean bull beef from well-grown yearlings has been proved—and has consumer approval—in a number of State and USDA studies. And when managed like steers, the bulls have been outstanding in growth and economy of production.

Practically all bull beef—of any age—goes on the market today as processed beef. And although the market potential beyond this is not fully known, it must be reexamined on the basis of new information on bull feeding.

Weanling bulls of the beef breeds grew significantly faster and more efficiently than their twins raised as steers—in closely controlled feedlot trials conducted by ARS scientists E. J. Warwick, R. L. Hiner, and R. E. Davis at Beltsville, Md. The bulls also showed up quite well in most carcass characteristics, although rating a little lower than the steers in tenderness and tastiness.

In these trials, the bulls gained an average of 2.10 pounds and their steer twins 1.72 pounds per day. They ate just a little over 1 percent more feed than the steers but produced 21 percent more daily gain.

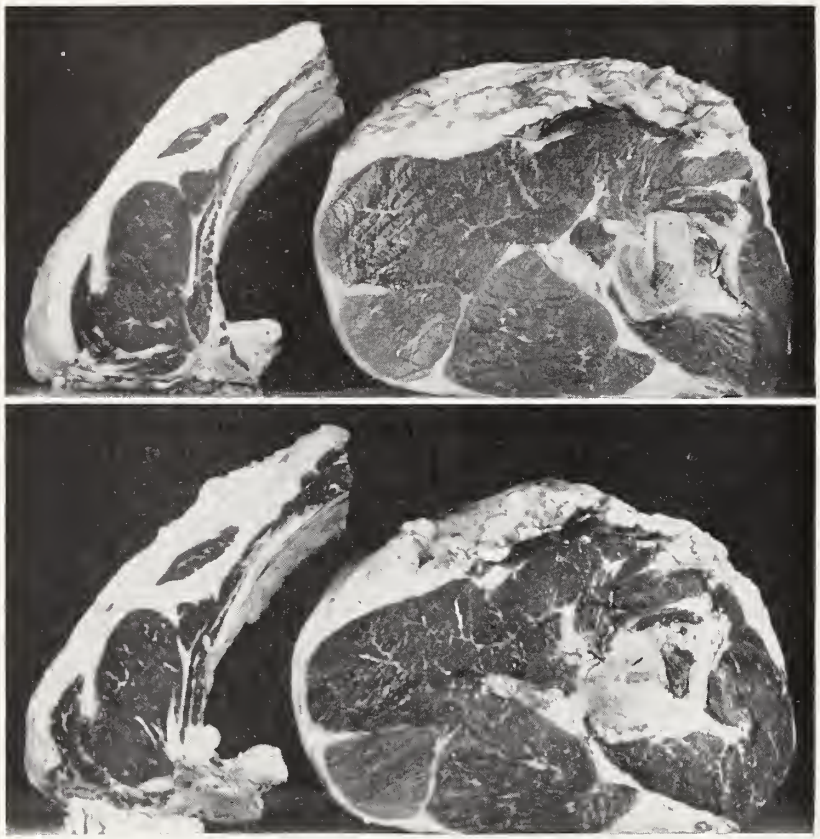
The bulls reached the slaughter weight of 900 pounds at 15 months of age, the steers at about 17 months. Both groups went on controlled feeding when 6 months old.

The bulls required 7.97 pounds of feed, and the steers 9.50 pounds, to produce 1 pound of gain. This was a saving in feed of 16 to 17 percent. Stated another way, the bulls produced 1.19 pounds of beef for every pound the steers produced—on the same amount of feed.

The bulls were more economical of feedlot labor and capital, too. The steers were in the feedlot for 11 months, but the bulls reached slaughter weight in only 9 months—thus saving some 18 percent in feedlot labor and overhead cost.

The bulls were particularly efficient in putting on lean beef: they had 10 percent more lean in the 9th-to-11th rib section than the steers had. And the bull carcasses carried 38 percent less fat—largely waste—over the ribeye area. However, the bulls had about 9.3 percent more bone in the rib section.

Does Bull Beef Have A Future? (*Continued*)



Angus bull cuts (top) compare favorably in ARS tests with cuts from twin (bottom). Most bulls in the study were about two-thirds of a grade lower than their steer twins—but within the range that consumers consider desirable.

The bulls also compared well with the steers in the percent of desirable cuts in the carcass. Their rib eye averaged nearly one-fifth larger. And the bulls' forequarters were a little heavier, chiefly due to a heavier chuck and neck.

A taste panel rated bull beef slightly less flavorful and tender than steer meat, and the Warner-Bratzler shear test confirmed the tenderness difference. The steer beef was moderately marbled; the bull meat a little less so. The bull beef was also slightly darker.

The bull carcasses graded between high Good and low Choice, the steer carcasses, middle Choice—all within the range that consumers consider desirable. The satisfactory quality rating of the bull beef is doubtless due partly to the bulls' rapid growth and youth when slaughtered. The meat had none of the objectionable flavor or other characteristics associated with meat from old bulls.

Similar results have been obtained at the agricultural experiment stations of Arkansas, Ohio, Pennsylvania, Nebraska, Tennessee, and Wyoming. The Ohio study also indicated that the male hormone androgen produced in the testis probably is responsible for the better performance of bulls.

The Beltsville scientists did not use stilbestrol (a synthetic female-like hormone) in these tests, but the Ohio scientists found that stilbestrol increased not only the growth rate of bulls but also their external fat. This fat covering raised their grade by one-third.

That consumers accept young bull beef has been shown in various independent studies. For example, bulls and steers of similar breeding, nutrition, and management were raised and slaughtered by the University of Wyoming, and the retail cuts were displayed together and priced the same in six local stores.

All cuts of bull meat, except loin steaks, outsold steer meat—by a margin of 3 to 2 in the case of chuck roasts. About 90 percent of the buyers of bull and steer meats alike said they would buy the same kinds of meat again. Between 85 and 91 percent of the buyers rated the meats "good" to "very good"—almost as many ratings for bull meats as for steer meats. And the meats were rated tender by 68 to 78 percent of the bull-beef buyers and by 78 to 81 percent of the steer-beef buyers. Bull round steak was rated tender least often—by 51 percent of its buyers.

Packers, wholesalers, and retailers need more information on how best to merchandise meat from young bulls, and how consumers would choose between bull beef at lower prices and steer meat at standard prices.

The individual who ventures into feeding young bulls also needs more information on what markets will accept his product and how much—and at what prices.

Buyers in some areas still discount young bulls heavily. And the producer needs much more information on production—best feeding plans, best market ages and weights, more breed information, especially about dairy breeds, and whether bulls will react well under large feedlot conditions.☆

Now Utilization Research Has Developed . . .

STRETCH LACE

■ Stretch cotton lace can be made by a simple, inexpensive treatment that makes it especially suitable for fitted slips, foundation garments, and lounging or sleeping apparel, which must be comfortable as well as attractive.

The treatment also improves the appearance of most laces—adding richness and depth to inexpensive laces for dresses, wraps, and other garments.

The treatment, called slack mercerization, consists of soaking woven lace in a solution of sodium hydroxide. This causes the fibers to swell and crimp, which in turn give the fabric stretchability.

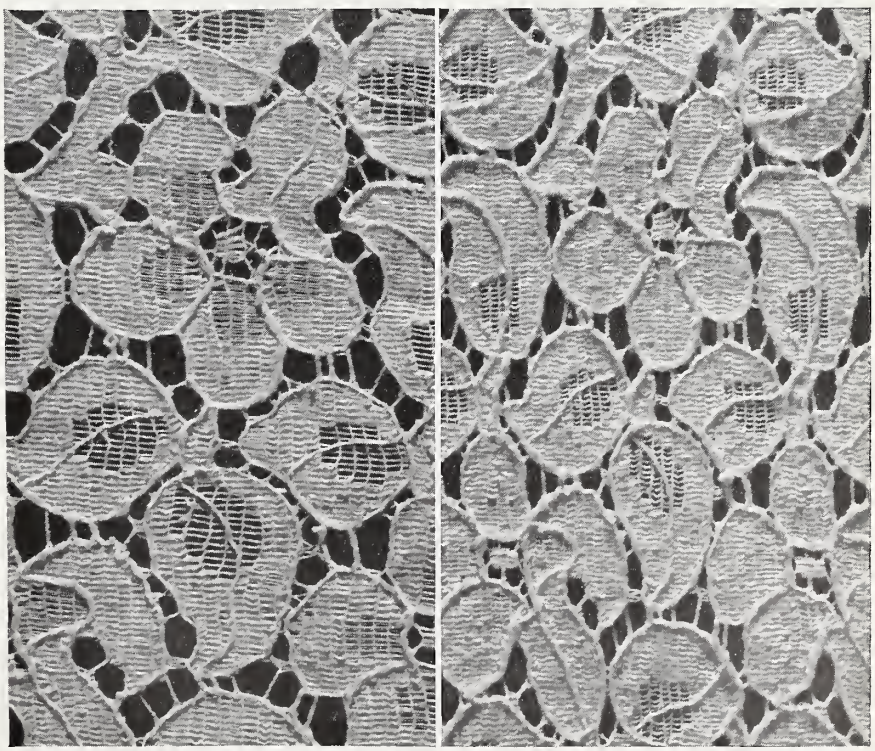
Helen M. Robinson and A. S. Cooper, Jr., of the Southern utilization research laboratory, New Orleans, have used the treatment with good results on a variety of laces, including inexpensive, lightweight flat lace; Cluny, a medium-price lace; and heavy Venice type. The greatest improvement in appearance occurs in the least expensive laces; after treatment, they look much heavier and richer.

Because the lace is treated after it has been woven, manufacturers can continue to use regular yarns and standard equipment to make stretch lace with the delicate and elaborate patterns that would be expensive and difficult to weave with stretch yarns.

Slack mercerization was developed earlier at the New Orleans laboratory and is now used by a number of commercial finishers to give stretch to woven and knit cotton fabrics (AGR. RES., November 1963, p. 11; December 1963, p. 15).☆

Cape made of slack mercerized cotton lace has richness found previously only in expensive laces.

Cotton lace after slack mercerization (right) has increased three-dimensional effect caused by treatment with the sodium hydroxide solution. The same type of cotton lace (left) is shown before treatment.



FOUND: The Light Switch for Plant Growth

ARS Scientists Isolate, Identify Pigment That Triggers Growth Processes

■ The "light switch" on phytochrome, the protein molecule that regulates many plant-growth processes, has been isolated and identified by ARS scientists at Beltsville, Md.

Beltsville scientists have been leaders in investigations of phytochrome, which they discovered—and named in 1959.

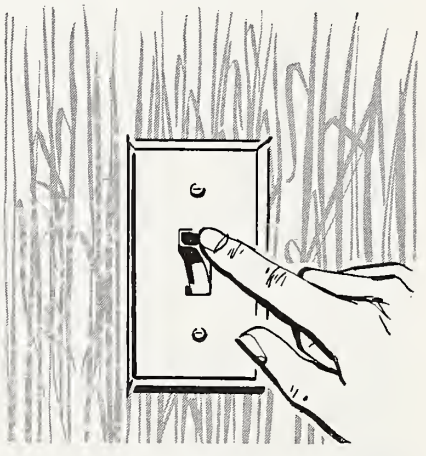
Their early studies showed that phytochrome, acting in response to light, governs flowering, stem elongation, germination, pigmentation, and many other growth processes (AGR. RES., May–June 1953, p. 3; July 1953, p. 14; June 1954, p. 8; July 1955, p. 12; May 1956, p. 16; December 1956, p. 10; July 1959, p. 14; November 1959, p. 3; April 1960, p. 15; July 1961, p. 10; and September 1964, p. 8).

Phytochrome exists in two forms—one active, the other inactive—and both are reversible by exposure to two kinds of light. When phytochrome is inactive, exposure to red light converts it to the active form; when it is active, exposure to far-red light converts it to the inactive form.

The switch that activates or inactivates phytochrome is chromophore, a light-absorbing (photoreceptive) bile pigment that constitutes an important 1 percent of the phytochrome molecule. It is this chromophore that has been isolated and identified by H. W. Siegelman and S. B. Hendricks.

Hendricks predicted more than a decade ago that the chromophore is a bile pigment, so the recent verification came as no surprise. Proof of the pigment's nature, however, is highly significant to scientists investigating plant and animal life.

The scientists isolated chromophore from phytochrome of oats—the first indication that bile pigments exist in higher forms of plant life (seed plants). In algae, bile pigments have an active role in photosynthesis, and in mammals in eliminating waste. Finding the growth-regulating function verifies that the different bile pigments, apparently closely related,



have vital and distinctly different functions in algae, seed plants, and mammals—and that their function depends on the kind of protein molecule to which they are attached.

Identification of the chromophore is one of the major achievements in about 15 years of intensive phytochrome research at Beltsville. Accomplishments during that time have brought worldwide recognition and honors to several ARS scientists.

After recognizing that some photoreceptive substance governs many aspects of plant growth, and developing a method to determine the activity of the substance, the scientists knew that three main steps lay ahead: (1) isolating phytochrome, (2) identifying it, and (3) determining its biological action.

When moderate purification of the phytochrome molecule had been achieved early in 1964, Siegelman and Hendricks concentrated on isolating the chromophore.

Although the chromophore is only about 1 percent of the entire phytochrome molecule, which in turn is about one-millionth of the plant, it is so important that its identification clears the way for investigations of how phytochrome functions.

The researchers know that phytochrome in its active state serves as an enzyme, and they can assume that substances (substrates) are present that the phytochrome uses to make other substances.

These substances made by phytochrome might be termed biochemical messages that are sent from the enzymatic action site to the growth site—to the terminal buds of the stems to control flowering, to the seed embryo to control germination, to the fruit skin to control pigmentation.

The task, now, is to learn what the substances are that phytochrome uses and makes, and how these interrelated systems function as the phytochrome responds to light—and "dictates" plant-growth processes.☆

In the dehydration process, alfalfa leaves are separated from stems after drying and prior to grinding. Leaves make a highly nutritive feed for hogs and poultry; stems can be fed to cows and sheep.

ALFALFA MEAL
for hogs and poultry

■ An improved alfalfa meal for hogs and poultry—one that is high in protein and low in fiber—has been developed by scientists at the Western utilization research laboratory, Albany, Calif.

The new product, made by inexpensive additional milling and screening steps in the dehydration process, is extremely rich in carotene and in vitamins E and K—all important growth accelerators for hogs and poultry. It is also high in xanthophyll, the pigment that produces golden-colored broilers and bright-yellow egg yolks.

The meal contains mostly leaves and small stems, approximately half of the whole alfalfa plant. The remaining half, largely stems, is suitable for cattle and sheep because they can utilize roughage well.

The new meal may be the answer to the feed industry's request for a higher quality commercial alfalfa meal for domestic and foreign markets. The principal commercial grade now on the market has 17 percent protein and 27 percent fiber. With the new process, the scientists say it will be possible for industry to produce a meal containing 25 percent protein and not over 19 percent crude fiber.

Studies were made of 22 cuttings of Lahontan, M o a p a, Buffalo, and Ranger alfalfa varieties from 3 geographical areas by ARS scientist G. O. Kohler of the Albany laboratory, and Joseph Chrisman, former executive director of the American Dehydrators Association. The research was financed largely by the Nebraska State Department of Agriculture.

The researchers have constructed a mobile, pilot-sized dehydrator for use this summer in California and Nebraska to provide information for use in scaling up the method to commercial levels.

The additional steps needed to produce the new alfalfa meal were added at the end of the normal dehydration process, where the chopped alfalfa comes out of the heated drum. At this point, the stems are still tough and can be readily separated from the dry, easily crumbled leaves.☆

Alfalfa leaves, high in protein but low in fiber, make up approximately 50 percent of the whole plant.

Magnified 188,000 times with an electron microscope, fibers of collagen are seen in cross section (craterlike bodies) and lengthwise (striped body).

AN INSIDE

Microscopists

■ ARS scientists are taking a look at the interior of hides and leathers at magnifications up to 200,000 times.

With such minute examination, they can see the basic structure of hide and how this structure is modified by defects or by changes in leather-making processes.

The studies are being made by microscopists A. L. Everett and R. J. Carroll at the Eastern utilization research laboratory, Philadelphia, using two high-power microscopes, each containing built-in photographic equipment. One is a light microscope capable of 1,000-fold magnification. The other is an electron microscope, whose electron beam can magnify up to 200,000 times—thus revealing the very structure of the molecules of collagen, the essential protein of hide.

Hide samples viewed in the light microscope are 20 to 40 microns thick (a micron is about 39 millionths of an inch), and those in the electron microscope are fractions of a micron.

Everett, assisted by H. J. Willard, is using the light microscope to study some frequently encountered leather defects. One of these is a condition called veininess—particularly troublesome in glazed calfskin because it produces a prominent blood vessel pattern on the grain surface. For some unknown reason, when hides in a single lot are processed identically, a few of them may look like roadmaps while the others have a smooth, blemish-free surface.

Microscopic cross-sections of veiny calfskins show large void spaces surrounding shrunken blood vessels immediately beneath the surface lines. These spaces are much smaller in perfect skins, suggesting that veininess reflects faults in the subsurface structure. Overcoming this defect, then, may be a matter of finding a way to fill in these spaces or to minimize them.

Also under microscopic study are fibers in certain thick hides, especially those fibers in the normally dense back area, where they may be oriented in such a way as to produce extremely weak leather. After these hides are split to uniform thickness, the cut fibers develop a characteristic pulpy appearance, and fragments of them are easily detached.

Everett has focused his microscope on sections of hide both with and without this defect. Pictures, particularly those taken under polarized light, show that fibers in pulpy hides run mostly in one direction—roughly perpendicular to the hide surface. The normal hide, on the other hand, shows a more random interweaving of fibers, giving strength and resistance to cracking. Although a way to overcome this defect is not yet in sight, microscopic analysis may lead to early detection methods that could eliminate the expense of processing defective hides.

Since animal hide is a far more complex substance than can be revealed by the light microscope alone, Everett is collaborating with Carroll, who works with the electron microscope. With this instrument, the smallest collagen fiber visible in the light microscope is seen as hundreds of parallel fibrils, each looking like a section of electric cable.

The microscopes are being used at overlapping magnifications to study an enzyme process designed to replace conventional liming for removing hair from hides before they are tanned (AGR. RES., October 1958, page 3). One of the advantages of this enzyme process would be elimination of the liming solution, now a waste-disposal problem.

Enzyme-processed hides unfortunately do not react to tanning in the same way as limed hides and require modified processing. To find out why, Everett and Carroll are studying the same samples from hides cut in two, half treated one way and half the other. At usual ranges of magnification, neither microscope has revealed

LOOK AT LEATHER

ly Defects—Determine Causes, Seek Remedies

any differences that would explain the reaction of enzyme-treated hides. The researchers hope that significant differences will become apparent as ultrathin sections are viewed by both instruments at intermediate levels of magnification.☆

Microscopist A. L. Everett (right) and H. J. Willard, assistant, compare hides in one phase of study.

A light microscope reveals the difference in fiber structure of weak and strong hides. The weak hide (above) has loose pulpy fibers running mostly in one direction. The interwoven fibers in the normal hide (below) adds strength. Magnification is about 40 times.

"Veiny" glazed calfskin has large void spaces around shrunken blood vessels directly beneath the surface lines. In a normal skin the spaces are much smaller. Magnification is about 70 times.

Cotton and bolls from stub plant (left) contrast sharply with those of well-fruited plant that was grown from seed. Both plants were damaged by boll weevils, the stub plant much earlier than the seed plant.

STUB COTTON: A WINTER HAVEN FOR WEEVILS

■ Western boll weevils that spend the winter in Arizona stub-cotton fields can cause significantly more damage to the crop than the weevils that emerge in August from thurberia (*Gossypium thurberii*), a wild cotton commonly found in Arizona and Sonora, Mexico.

These stub-cotton fields—where plants are cut at ground level and allowed to grow a second season or more—help the weevils increase both their range and their severity of attack by serving as a winter haven. Although the weevil is not yet a major pest in Arizona, it could develop into a serious problem there and eventually spread to California if more effective measures are not initiated against stubbing.

ARS entomologist C. T. Bottger, working cooperatively with scientists at the University of Arizona, found live weevils as early as mid-April 1964 in stub-cotton bolls that had remained on the soil surface. The first egg-punctured square appeared on stub cotton the last week in May, the first on planted cotton in mid-July.

On September 2, Bottger found 22,118 egg-punctured squares and 864 adult boll weevils per acre in a stub cotton field but none of either in a planted cotton field nearby. By the end of September, the per-acre count of egg-punctured squares was 43,964 in the stub cotton and 422 in the planted cotton. Competition for fruiting forms in stub cotton forced large numbers of the weevils into surrounding planted cotton fields, causing the

infestation to climb rapidly. Losses of 1½ bales of cotton per acre were not uncommon in the infested stub fields.

Most cotton is planted from seed each year, and the crop residue is plowed under following harvest. In stub cotton fields, early spring irrigation softens the bolls so that overwintering weevils emerge long before their opposite numbers from thurberia bolls, which do not soften until after the summer rains. The early emerged weevils survive by feeding on foilage of the stub plants until squares become available for egg laying.

Because stub cotton permits several extra weevil generations, this production practice could result in a greater increase in the number of weevils that would overwinter each year. If this were to happen, Bottger says, the western boll weevil would become a major pest of cotton in this area.☆

Several mature larvae attack a cotton boll from a stub cotton plant. Stub plants are cut at ground level, then allowed to grow a second season or more.

Stub cotton plant (left) has last season's broken base. Its almost barren upper portion is a result of early boll weevil damage. Far more squares, bolls, and leaves are on the other plant, grown from seed.

Can We Guide Honey Bees?

Attract Them . . . For Pollination
Repel Them . . . From Insecticides

■ Developing methods to protect beneficial insects and help them help man is an important part of the research entomologist's job. A search for materials that attract or repel honey bees is a case in point.

As part of continuing studies of insect repellents and attractants, ARS and Arizona scientists have tested 195 formulations for the effect their vapors have on honey bees. They found four formulations that rate weak to moderate as attractants and 18 that rate moderate to strong as repellents.

Although the screening program is providing fundamental information about honey bee behavior, the researchers are looking toward the day when formulas might be used to attract honey bees for pollination purposes. They also say that a repellent added to an insecticide might someday keep bees away from areas in which toxic materials have been used. Repellent materials might even be used to keep bees away from the family picnic.

The experiments were conducted by ARS entomologist A. W. Woodrow and chemist Nathan Green, both of ARS, statistician Henry Tucker of the University of Arizona, and agronomists M. H. Schonhorst and K. C. Hamilton of the Arizona Agricultural Experiment Station.

The researchers noted the reactions of bees when vapors of various natural and synthetic compounds were wafted over them. The tests were conducted in a specially constructed modified olfactometer, an instrument used to determine whether insects are affected by an odor.

If bees moved toward the vapors, the material was rated as an attractant; if they moved away from the vapors, it was rated as a repellent. Reaction to each compound was compared with reaction to propionic acid, a relatively harmless, easy-to-handle acid similar to acetic. The researchers chose this acid as a standard gage because of the uniformity of the bees' reaction to it.

Bees' reactions to the repellents proved more consistent than to the attractants. The strongest repellents included amines, acids (or acid anhydrides), and carbonyl components. Of the four attractants, three were alcohols and one was a fatty acid having four carbon atoms. The researchers now plan to test more extensively those formulations that elicited the strongest reactions from the bees.☆

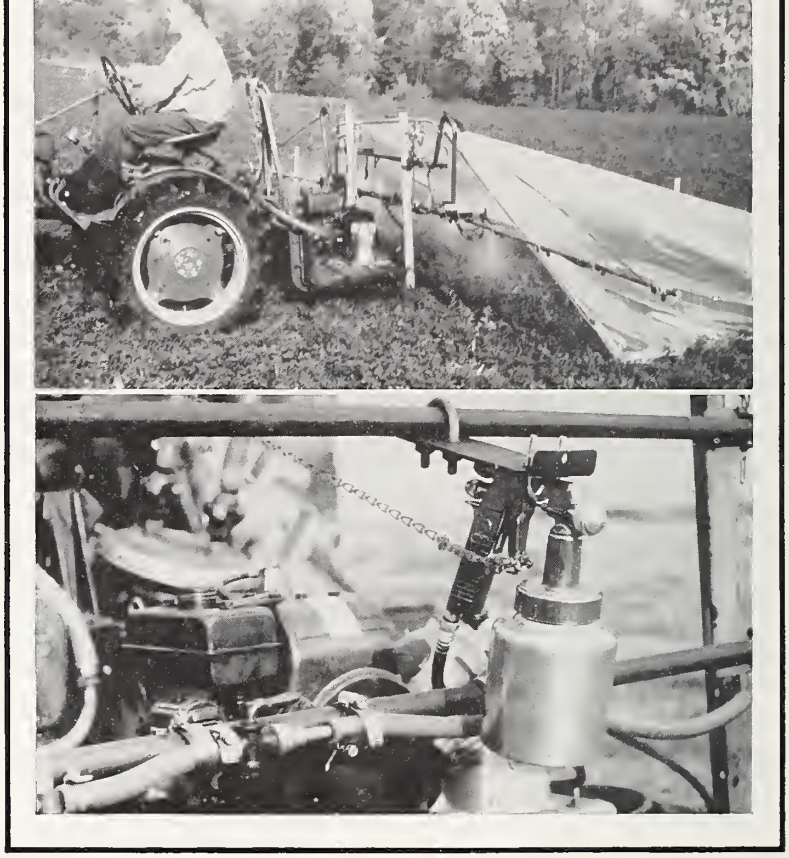
Low-Volume Ground Spray Equipment Uses . . .

THE AEROSOL APPROACH

■ A ground sprayer that applies undiluted malathion at extremely low rates per acre for insect control is under development for farm use by ARS scientists at Beltsville, Md.

Indoor calibration tests indicate that some crops can be protected by as little as 2 ounces of chemical per acre when applied as an aerosol spray. The experimental applicator is now being field tested to determine its effectiveness when used in alfalfa against alfalfa weevils.

Low-volume application was first developed by ARS for use in aerial spraying. The aerial technique has proved highly successful against grasshoppers, cereal leaf beetles, and boll weevils (AGR. RES.. March 1965, p. 10; June 1965, p. 11).



Insecticide is sprayed onto the crop beneath a weighted plastic canopy (above), to increase efficiency and eliminate drift. The experimental unit (below), built with components that are available at most farm-supply stores for about $100, consists of a compressed-air spray gun, a spray boom, and a compressor driven by a 1-cylinder, 4-cycle engine mounted on the rear of a farm tractor.

Has low toxicity to animals

Malathion is used in both the aerial and the experimental ground equipment because of its low toxicity to warm-blooded animals, which minimizes possible adverse effects on humans, livestock, and wildlife. Elimination of the large amounts of water, oil, or other diluent used in conventional sprays sharply reduces costs of application.

The aerosol applicator was designed by mechanical engineer A. H. Yeomans, working with entomologist V. E. Adler and physical science aid E. S. Fields. They say commercial production of the applicator should not be difficult or costly; the experimental unit was built at Beltsville from components that are available at most farm supply stores at a total cost of about $100.

The applicator consists of a compressed-air spray gun hand operated, a spray boom, and a compressor driven by a 1-cylinder, 4-cycle engine mounted on the rear of a farm tractor. As the tractor moves through the field, the sprayer releases the undiluted malathion beneath a weighted plastic canopy. The back pressure of air under the canopy keeps the finely atomized droplets from touching the canopy itself and deflects them onto the foliage that is being treated.

Droplets average only 15 microns

The indoor tests, confined largely to determining the aerosol applicator's performance, showed that the dispersed droplets average only 15 microns in diameter—well within the aerosol range of 1 to 50 microns.

Caution: In using insecticides, follow directions and heed precautions on the label, particularly when there is danger to wildlife or possible contamination of water supplies.☆

INOCULATING COTYLEDONS

New Laboratory Technique Speeds Screening of Alfalfa for Bacterial Wilt

■ A new technique enabling plant breeders to quickly and accurately evaluate alfalfa varieties and breeding lines for resistance to bacterial wilt has been developed by ARS plant pathologist K. W. Kreitlow at Beltsville, Md.

With this new time-saving technique — called cotyledon inoculation—researchers can infect 7-day-old alfalfa seedlings with bacterial wilt through wounded (clipped) cotyledons. Then within 5 to 6 weeks, they can inspect the seedling taproots for discoloration, a reliable indication of wilt infection. The complete process takes only 6 to 8 weeks from the time the seed is sown until the alfalfa plants have been evaluated.

Kreitlow infects the seedling by clipping off the terminal one-third to one-half of each cotyledon; he then sprays or smears wilt bacteria on the wounded cotyledon.

Using the conventional method—inoculation through the roots—alfalfa plants must be grown 4 months to 2 years before they can be evaluated for wilt resistance. Often during root inoculation, other bacteria and fungi invade the alfalfa roots through the same wound. These organisms also produce discoloration and rottening, which can often obscure plant reaction to bacterial wilt.

Kreitlow points out that the new method not only saves time but also avoids the invasion of other bacteria and fungi. He was able to re-isolate wilt bacteria in almost pure culture from discolored seedling roots.

Although some seedlings develop foliar symptoms of bacterial wilt after treatment, the most reliable indication of wilt infection is the presence of discoloration inside the taproot.

Discoloration usually develops enough for accurate evaluation 36 to 43 days after the cotyledon is inoculated. Seedlings that have good resistance to the bacterial wilt infection will have normal-appearing roots during this period.☆

RIGHT—Taproots of 8-week-old alfalfa seedlings (two at right) show internal discoloration caused by bacterial wilt. Accurate reading of coloration can usually be obtained 36 to 43 days after inoculation. The root at left is healthy.

BELOW—Cotyledons of 7-day-old alfalfa seedlings are clipped, then infected with bacterial wilt. Conventional method requires inoculation of seedling through roots.

In tests against malaria-carrying mosquitoes, the entomologists treated insides of buildings, where the mosquitoes rest during daylight hours. Some of the treatments were still effective 1 year later.

AGAINST MALARIA

Can *Anopheles* Mosquitoes Be Controlled With One Treatment Per Season?

■ ARS entomologists have found several insecticides that show promise as replacements for DDT and dieldrin in the worldwide campaign against malaria-carrying mosquitoes.

The work is in cooperation with the World Health Organization and the Department of Defense, as part of a continuing effort to protect both civilians and military personnel from disease-carrying pests. One of the most deadly of these is the malaria mosquito.

Although large-scale efforts to eradicate malaria have been conducted in many parts of the world, an estimated 2 million people still die annually from this disease. Among the problems encountered in these efforts has been the ability of the carrier mosquito to develop resistance to the insecticides used—making it necessary for scientists to find new ones to take their place. (For another report of ARS research on mosquito control, see AGR. RES., June 1965, p. 11.)

Pesticides are needed that not only will kill resistant mosquitoes but also can be applied in smaller dosages and remain effective longer—for example, one application per season. (Length of the mosquito season varies from one area of the world to another.)

Mosquitoes become infected with malaria when they feed on a person who has the disease. The malaria parasites must then develop inside the mosquitoes for more than a week before they can be transmitted to another person. Because many species of *Anopheles* mosquitoes spend the daylight hours resting in buildings, insecticides applied to the walls and ceilings help to prevent spread of malaria by killing mosquitoes before they become carriers.

In tests conducted near Stuttgart, Ark., ARS entomologists J. B. Gahan, H. G. Wilson, and C. N. Smith found that certain methylcarbamates were equal to DDT in controlling *A. quadrimaculatus*—the mosquito that at one time carried malaria in the United States.

During the first summer of the tests, the scientists sprayed a group of farm buildings with 200 milligrams of insecticide per square foot. Some of the compounds were still effective in controlling mosquitoes the following season (after more than a year). The second summer, the scientists sprayed an additional group of buildings at half the earlier application rate, and the 100 mg. was as effective during the season (12 weeks) as the 200 mg. had been the year before.

The most promising of the compounds studied was *o*-isopropoxyphenyl methylcarbamate, which "knocked down" the mosquitoes rapidly when freshly applied and gave good control as a residual the second summer. It produced no unsightly residue when applied as an emulsion and was no more objectionable as a water-dispersible powder than presently used insecticides. It had only a slight odor. (The compound is registered with USDA for limited use by professional pest-control operators.)

The scientists are not yet ready to make recommendations on the compounds studied. They're now conducting additional tests to find out, among other things, which compounds can be applied at the lowest rate and remain effective for the longest time.

Gahan was the first scientist to observe that residual applications of DDT applied in buildings controlled malaria-carrying mosquitoes. His studies were conducted in Florida, Arkansas, and Mexico about 20 years ago. Since that time, DDT has been credited with saving millions of lives throughout the world when applied in this manner.☆

How fast should milk be cooled?

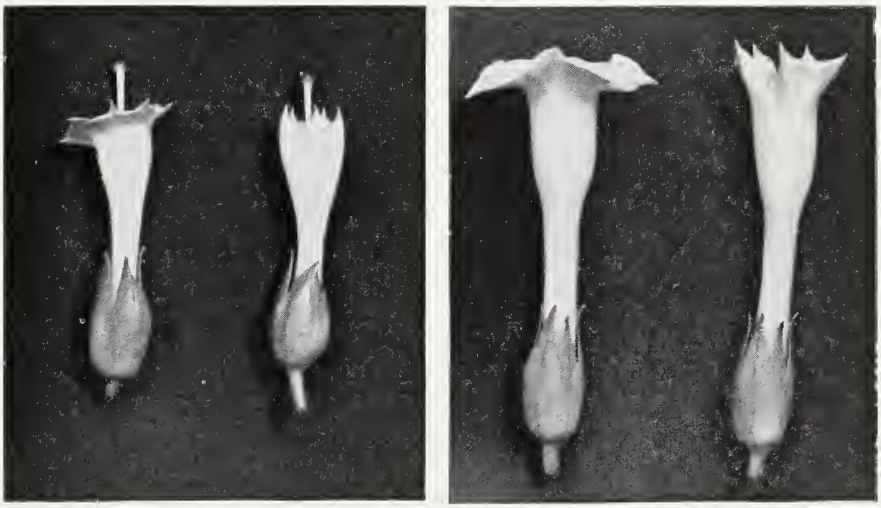
ARS scientists have completed the first stage of research to get a precise answer to the question: How fast must you cool milk in a bulk tank?

Milksheds regulate the cooling rate of milk, usually stipulating 1 hour to reach 50° F. So far, no research results are available to support the hour cooling period, but it is judged to be within a safe time limit.

Fast cooling is costly, however, and may cause a portion of the milk to freeze, thereby possibly harming the flavor. Slow cooling also has its dangers: Bacteria multiply much more rapidly at higher temperatures and, if cooling is too slow, the milk can deteriorate noticeably.

ARS microbiologist W. D. Schultze and dairy husbandman J. W. Smith have taken as long as 4 hours after milking to cool high-quality milk from body temperature to 50 degrees. They found that the 4-hour cooling period permitted excessive bacterial growth even in milk of highest quality. First indications, however, are that milk of uniformly high quality can be cooled safely to 50 degrees in 2½ hours.

Schultze and Smith emphasize that these preliminary findings apply only to research conditions. They are presently conducting tests with milk having higher bacteria counts in bulk coolers of various designs, hoping to cover all the conditions a typical milk hauler may find on his route. The research is expected to yield objective information on which quality-control authorities can base the optimum time limit for cooling milk in bulk tanks.



The stigmas of the new male-sterile tobacco lines (left) protrude well above the corolla, which allows for the easy application of pollen by the breeders. Stigmas in normal tobacco flowers (right), as well as in many male-sterile lines, are hidden.

Protruding stigmas aid pollinating

A labor-saving feature has been bred into two male-sterile tobacco lines that plant breeders are using this year in hybrid tobacco breeding.

In normal tobacco flowers, and most types of male-sterile tobaccos, the stigma (the part of the pistil of the flower that receives pollen grains) is deep inside the flower. The breeder must split the flower open before applying pollen. In the two new male-sterile lines, the stigma protrudes well above the flower, where the breeder can easily apply pollen.

Tests have shown that it takes only 12 minutes to pollinate 100 flowers if the stigma is protruding, compared with 26 minutes if the stigma is hidden. This feature can save many valuable hours for a breeder who must pollinate thousands of male-sterile flowers.

The new breeding lines, designated PDMS–1 and PDMS–2, were developed by ARS agronomist J. F. Chaplin, in research cooperative with the South Carolina Agricultural Experiment Station at Florence.

Chaplin obtained eight sources of male-sterile tobaccos for his breeding work, which he grouped into six flower types. One of these, designated Type 5, had stigmas protruding ¼ to ½ inch above the flower. He transferred this flower type into PDMS–1 and PDMS–2.

The new male-sterile lines were distributed earlier this year to plant breeders in Georgia, North Carolina and South Carolina. They are available also to breeders in other States.

UNITED STATES GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS, WASHINGTON, D.C., 20402

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)

A simplified test for bean blight

Puncturing infected tissue of bean plants with a needle is one of the steps in a quick, simple method that an ARS plant pathologist has developed for isolating disease-causing bacteria.

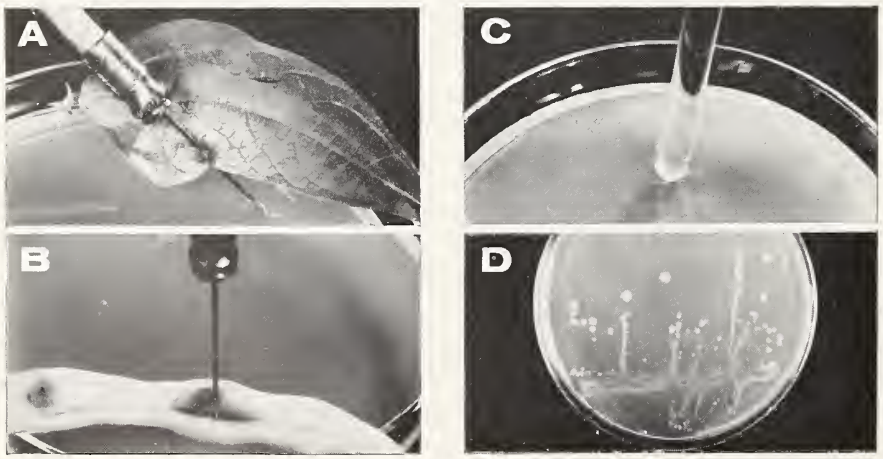
Because symptoms of several bacterial diseases of beans may closely resemble one another, scientists often must isolate pathogens from tissue of an infected plant to be sure which disease it has. Recent increases in the incidence of halo blight have caused researchers to seek easier ways to distinguish the disease from common and fuscous blights and bacterial brown spot.

The new isolation method takes only a minute or two, contrasted with 10 to 15 minutes required for the method now in use.

The traditional isolation method involves a long series of operations—sterilizing the surface of the infected tissue, placing pieces of the tissue in sterile water or nutrient broth, crushing the tissue, then making either a series of dilutions or streaking on an agar surface where the organisms can develop.

The needle-puncture technique developed by ARS plant pathologist R. W. Goth is much simpler. He holds an infected leaf or small stem over a petri dish containing hardened nutrient agar and punctures the margin of a disease lesion with a flame-sterilized needle, forcing it through the lesion to transfer bacteria into the agar. For thicker pods and mature stems, he punctures the lesion, then withdraws the needle before stabbing the agar. In both cases, he then streaks the bacteria on the agar with a sterile glass rod, which helps separate out individual bacteria. These procedures eliminate the need to sterilize tissue surface of treated stems or leaves.

The new puncture method below shows (A) needle passing through foliar lesion and into nutrient agar, (B) needle in pod lesion, (C) glass rod streaking bacteria on agar, and (D) agar 72 hours after streaking.



Scientists rank chemosterilants

Tepa, metepa, apholate, and tretamine were the most promising of 296 chemical compounds tested in Hawaii for their effectiveness in sterilizing the melon fly, the oriental fruit fly, and the Mediterranean fruit fly.

These four chemicals did an outstanding job of sterilizing both the male and female insects; four other materials were unusually effective in sterilizing females only.

In 5-year tests, ARS entomologists Irving Keiser, L. F. Steiner, and Hitoshi Kamasaki found that tepa, apholate, and tretamine are as effective as radiation in sterilizing the insects and look promising for field application in combination with baits. Experimental work is continuing to insure the development of safe and practical ways to use the materials.

The researchers treated the insects' food and water, applied materials directly to pupae and adults, and exposed adults to deposits of the chemosterilant materials. Treatments were most effective against newly emerged flies; but within 24–48 hours after treatment, even eggs from older fertile females did not hatch.

The entomologists say that lower concentrations of chemosterilant usually were needed to sterilize males than to sterilize females. The melon fly generally had the greatest susceptibility to test materials, followed by the oriental fruit fly and the Mediterranean fruit fly.

U.S. GOVERNMENT PRINTING OFFICE:1965